Field Level Construction Management – Engineering Technology Applications for Transportation Projects

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What is the purpose of keeping construction project records? Generally speaking, the purpose of record keeping is to collect, organize and present information. During construction, important documents such as daily reports, are kept to confirm contract conformance (or non-performance) and record work progress. These records are also used for solving problems during construction or resolving disputes. In many cases, construction records are the most significant source of information used during litigation. For all these purposes, it is very important that documents created during construction are accurate, legible and produced and organized in the most efficient manner possible.

For many transportation and public works agencies, there exists potential for improvement upon standard documentation procedures, by adopting information technology (IT) solutions that have proven successful for building and private sector projects. Daily reports can be created using a hand-held data collector such as a personal digital assistant (PDA). Instead of filing daily reports and other project records in the traditional manner (i.e. file cabinet), information can be stored electronically and indexed into a data-base or spreadsheet. By indexing information electronically, it can be sorted and accessed for future uses including problem solving, dispute resolution or litigation support. Computer Aided Drawing (CAD) is another proven technology that can be used to improve the accuracy and clarity of construction documents. Once adopted, these technologies (PDA, Data-Base and CAD) should improve a record keeping system. These technologies have been used with success on Virginia Department of Transportation (VDOT) projects by McDonough Bolyard Peck (MBP).

CAD is used extensively during the design of transportation projects, but seldom during construction. Why should CAD be used during construction? A construction document's clarity can be improved by using CAD to create new a drawing or to manipulate an existing drawing. Ideas can be shared because CAD drawings can be transmitted electronically. For example, the construction team could submit ideas or Requests for Information (RFI) to the design team. CAD sketches can also be added to reports to illustrate work progress, new concepts, problems or changes. The software and skills required to perform simple CAD work are not expensive or difficult to obtain. A software license for the construction team can usually be added to the license agreement and the plans can be delivered electronically. There are also less expensive CAD programs which limit the user to 'redline' functions, but will allow basic functions required to make construction sketches.

During construction of the Atlee-Elmont Interchange at Interstate 95 near Richmond, Virginia, MBP added CAD services to the existing documentation procedures. This service was added at no additional cost to VDOT, only required one MBP employee to attend a one-week training seminar. Since adding CAD to the available project documentation tools, the inspection staff has used the system regularly.

The PDA is a tool ideally suited to field data collection. They are portable and can store large amounts of information. A PDA user can record information 'as it happens' in the field using hand-held word processing, spreadsheet and database software. At the same time, important contract documents, specifications and correspondence can be retrieved as needed. A PDA user will no longer be required to spend time in the office typing reports into a computer or, carry large volumes of paperwork in order to keep relevant information accessible. Durability and cost will limit the widespread acceptance of the PDA as a replacement for the field notebook. When

using a PDA in the field, the user may experience difficulty reading the small screen, especially in direct sunlight. Of course a PDA requires regular battery charging and needs to be handled carefully to avoid damage. Future products will likely improve on these points.

A very important component to a document filing system is organization which dictates the user's ability to retrieve key information. Traditional filing involves file cabinets full of carefully labeled and indexed paperwork. Once established the information can only be accessed through the set indexing system. For example, most daily reports are grouped by project section and sorted by date. Using this system a user wishes to retrieve a list of equipment used on certain project activities, they would be required to review a stack of papers and in essence 'hunt' for the information. A Database is a computer application that accepts large volumes of information and indexes the information for use in multiple locations. As with the previous example, daily reports are electronically sorted by date, equipment allocations and project activity, thereby provided a list of the user's required information.

MBP has created a Data-base called MBProject using Microsoft's Access program. The program is similar, but much less expensive than other project management software. MBProject was originally built for use on VDOT inspection projects and interfaces with VDOT's Construction Work Book (CWB) system. However MBProject has been successfully modified for other projects, including post-construction claim analysis. The system allows multiple users to enter daily records of weather, time, construction activities, problems, pay items, equipment, labor, visitors and general notes. This information can be later retrieved for the creation of as-built schedules, issue narratives (useful during dispute resolution and litigation), change order logs, submittal logs and pay estimates. Printed reports are automatically generated for backup copies. MBP continues to update MBProject and develop new uses such as a hand-held, PDA-based version.

The construction management (CM) process is constantly evolving and new technology can be part of a CM team's improvement. Or, changes brought on by the introduction of new technology can baffle employees, waste time and money. In light of these realities, professional CM practitioners face the question: Does change have to be sudden? While bold steps sound appealing, experience has shown that gradual progressive changes are more effective. CAD, PDA and Data-base are three IT advancements that should make a key part of an organizations gradual change, because the potential benefits far outweigh the costs.

The future of construction documentation will be shaped by technology. In order to stay productive and efficient, users will need to understand and accept each advance as they become practical. Transportation projects will continue to move away from traditional methods and towards these new technologies.